

JPL SURP Strategic Topic Areas - 2008

Topic Area:	9. Large, Precise Space Structures to Enable Future Observing Instruments
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Remote sensing instruments to probe electromagnetic or gravitational signatures from space rely critically on the sensitivity of the instruments, as well as on the spatial extent of the platform to support resolution-enhancing increases in aperture diameters and/or measurement baselines. Because costs of launch and the launch vehicles themselves severely constrain the overall size of instruments, new techniques for systems that deploy from stowage configurations to spatial extents much larger than rocket fairings must be developed. While the techniques being developed on the JWST mission are leading examples of such precision deployment, future instruments call for even larger deployed-to-stowed volume ratios.

The deployed structure, whether mechanically interconnected by struts and hinges that actuate from compact launch configurations or realized as a virtual structure via multiple spacecraft flying in precise coordinated formation, must provide sub-wavelength stability over its full extent. Applications of interest are structures to support telescopes, interferometers, and microwave to sub-millimeter antennae systems.

Success is measured by significant improvements relative to the state-of-the-art in strength to mass ratio, improved dynamic performance, and the degree to which predictive precision performance modeling matches real-world structural behavior (e.g., micro-precision linear performance).

Technologies and capabilities of interest include but are not limited to:

- Improvements in lightweight precision structural materials
 - Linear behavior (absence of micro-dynamic effects)
 - High strength, low density, dimensionally stable
 - Wide temperature range extending to cryogenic regimes
- Improvements in hinges, latches, and joints
 - Linear behavior
 - Reduced mass
 - Wide temperature range
- Improvements in passive and active dimensional control of rigid and virtual structures
 - In-flight metrology components
 - Low power, long life
 - Metrology and control algorithms
 - Pointing and tracking between cooperative virtual structure elements
 - Precision spacecraft constellations
 - Active or adaptive optical wave-front sensing and control
- Improvements in structural dynamics of both physical and virtual structures
 - Active and passive vibration damping
 - Efficient pointing and tracking
- Improvements in integrated modeling and model validation techniques